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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/625,490

07/22/2003

A. Farid Issaq

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EXAMINER

TRAN, THIEN F

ART UNIT

PAPER NUMBER

2811

MAIL DATE

DELIVERY MODE

05/18/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/625,490

Applicant(s)

ISSAQ ET AL.

Examiner

Thien F. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 11, 12 and 14-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 11, 12 and 14-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 04/19/2007 has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 11-12 and 14-19 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The recitation of a first layer of a barrier metal disposed above and in electrical contact with said tungsten plug forming a first electrode in claim 11 sets forth a structure not supported by the elected species 5 illustrated in Fig. 3A. Applicant did not point out exactly wherein the application with respect to the elected species 5 (Fig. 3A) that shows or discloses a first layer of a barrier metal disposed above and in electrical contact with said tungsten plug forming a

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first electrode. It is noted that the elected Fig. 3A shows only one layer (24) of a barrier metal disposed over said antifuse layer (22) forming a second electrode. Fig. 3A does not show a first layer of a barrier metal disposed above and in electrical contact with the tungsten plug forming a first electrode. It appears the claim language is inconsistent with what is being described in the application with respect to the elected species 5 of Fig. 3A.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 11-12 and 14-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 11 recites the limitation "said first insulating layer" in line 15. There is insufficient antecedent basis for this limitation in the claim.

Claim 11 recites the limitation "said second layer of said barrier metal" in lines 16-17. There is insufficient antecedent basis for this limitation in the claim.

Claim 18 recites the limitation "said second layer of said barrier metal" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 19 recites the limitation "said second layer of said barrier metal" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 11, 12, 14, 15 and 17-18, insofar as in compliance with 35 USC 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley et al (US 6,437,365) in view of Jain et al (US 6,107,165) and Gangopadhyay (US 6,114,714).

Regarding claims 11, 12, 17 and 18, Hawley et al teach a metal-to-metal antifuse comprising (Fig 6): a tungsten plug (18) disposed in a via in an insulating layer (16) disposed above and in electrical contact with a lower metal interconnection layer (14); a first layer of a barrier metal (42) disposed above and in electrical contact with said tungsten plug forming a first electrode, said first layer of said barrier metal comprising a titanium nitride (TiN); an antifuse layer (20) disposed above an upper surface of said tungsten plug, said antifuse layer comprising a lower SiN layer (22) considered as a lower adhesion-promoting layer, a middle layer (24) comprising amorphous silicon, and an upper SiN layer (26) considered as an upper adhesion-promoting layer; a second layer of a barrier metal (30) disposed over said antifuse layer forming a second electrode, said second layer of said barrier metal comprising a titanium nitride; and a second insulating layer of oxide layer (52) disposed over said first insulating layer (16), said antifuse layer, said first layer of said barrier metal, and said second layer of said barrier metal.

Hawley et al. do not teach that the first and second layers of a barrier metal comprising tantalum nitride. Jain et al. teach titanium nitride and tantalum nitride can be used for barrier metal (col. 4, line 66 - col. 5, line 3). Therefore, it would have been

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obvious to one of ordinary skill in the art at the time the invention was made to substitute the titanium nitride of Hawley with tantalum nitride as taught by Jain since titanium nitride and tantalum nitride are art recognized barrier metal material.

Hawley et al. in view of Jain do not teach the middle layer (24) comprising hydrogen doped amorphous carbon. Gangopadhyay teaches a hydrogen doped amorphous carbon used for antifuse material (2, Fig.1A). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute amorphous silicon with hydrogen doped amorphous carbon since amorphous carbon could reduce ON-OFF switching and leakage current.

Hawley, Jain and Gangopadhyay disclose the same structure as claimed but do not explicitly teach that the SiN layers (22 & 26) are adhesion-promoting layers. However, the adhesion-promoting layer of the present invention is formed of SiN or SiC (see page 3, Summary section in the specification, paragraph 0007); therefore, the SiN layers (22, 26) on both sides of the middle layer (24) of hydrogen doped amorphous carbon using the same material disclosed by the present invention inherently function as "adhesion-promoting layer" and would meet the recited term "a lower adhesion-promoting layer" and "an upper adhesion-promoting layer".

Regarding claim 14, Hawley et al. teach said antifuse layer having a thickness of 61 nm (col. 4, lines 29-32).

Regarding claim 15, Hawley et al. teach the first and second barrier metal having a thickness of 200 nm (col. 4, lines 5-9 & col. 6, lines 26-30).

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Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley, Jain, and Gangopadhyay, as applied to claim 11 above, and further in view of Han et al. (US 6,583,953).

Hawley et al. do not teach SiC used as an adhesion-promoting layer for the carbon. Han et al. teach in Fig.4, a SiC interlayer (60) forms as an adhesion layer for Carbon layer (66). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select SiC instead of SiN as an adhesion layer that would have improved adhesive properties over conventional silicon-based adhesion layers like SiN (col. 4, lines 21-24).

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley, Jain, and Gangopadhyay, as applied to claim 11 above, and further in view of Forouhi (US 5,181,096).

Hawley et al. do not teach a tungsten layer atop the barrier metal layer. Forouhi in Fig.1 teaches a tungsten layer (30) formed on the barrier metal (28). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching Forouhi with Hawley in order to produce a device with a process compatible electrode.

Response to Arguments

Applicant's arguments filed 04/19/2007 have been fully considered but they are not persuasive. Applicant states that claims have been amended to remove reference to a lower barrier layer which is not true. It is noted that the lower barrier layer is the first layer of barrier metal recited in claim 11. This first layer of barrier metal is the issue that

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raises the 112 problem and applicant did not remove this element from the claim . As such, the 112 rejection is maintained.

In response to applicant's argument that no one skilled in the art would combine these prior art and one cannot simply arbitrarily mix and match individual component layers from device to device as the examiner has done, the examiner respectfully disagrees with the remark because most inventions are an improvement of the prior art. It is obvious for one having ordinary skill in the art to modify a prior art by coming up with different materials for the antifuse layer of Hawley et al. by using the antifuse material disclosed by Gangopadhyay for some advantage or expected beneficial result produced by their combination.

In response to applicant's argument that the examiner has given no consideration to the critical portion of the "function" of the adhesion-promoting layer, the examiner did address the "function" of the adhesion-promoting layer and has given it weight. It is the examiner's position that the adhesion-promoting layer recited in the claim is not patentably distinguished from the adhesion-promoting layers (22, 26) of the prior art. Applicant is required to prove that the subject matter shown to be in the prior art does not possess the characteristic relied on. In re Swinehart, 169 USPQ 226 (CCPA 1971).

Applicant further argues that the claimed antifuse structure is unobvious over the prior art of record because the claimed combination unexpectedly exhibits markedly different and superior characteristics which the examiner respectfully disagrees. Applicant's argument cannot take the place of evidence in the record. Applicant has not

provided convincing scientific evidence to support his contention that the structure of the combined teachings of the prior art does not possess the same characteristics relied on. See MPEP 716.01 (c) for examples of attorney statements which are not evidence and which must be supported by an appropriate affidavit or declaration. The graphs in Figs. 11-13 are not of the applied prior art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thien F. Tran whose telephone number is (571) 272-1665. The examiner can normally be reached on 6:30AM - 3:00PM Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Thien F Tran
Thien F Tran
Primary Examiner
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May 10, 2007